

Coatings
Corrosion
Fracture and Mechanical Testing
High Temperature Mechanical Properties
Hydrogen Production and Storage Materials
Hydrogen Separation Materials
Irradiation
Materials Validation
Microstructure and Physical Properties
Modeling
Neutron Radiography
Nondestructive Evaluation
Post-irradiation Examination
Synthesis and Processing of Novel Materials
Welding and Joining
X-Ray Radiography

Materials Validation

Capabilities/Facilities

Materials science, materials engineering, welding engineering, high temperature materials testing, high temperature material property measurements, codes and standards, and quality assurance. Drop weight tower and drop pad impact facilities; laser flash thermal property measurement system, vibration/shake tables. High temperature specialized heater development, fabrication and testing.

Materials

Nickel-based alloys, stainless steels, oxide dispersion strengthened alloys, ferritic/martensitic alloys, advanced intermetallics, construction materials, and fuel materials. Depleted uranium dioxide, thorium dioxide, and non-radioactive ceramic materials.

Scientific/Engineering Issues

Data developed in literature searches and scientific investigations is evaluated and applied to the design

and construction of nuclear systems. Materials engineering support is provided for development and application of specifications for fabrication of nuclear system components and specialized instrumentation. Material and structural response to tension, bending, shear and combinations of load when subjected to impact are investigated. High temperature laboratory equipment is used to obtain key insights about materials compatibility, interactions and instrumentation survivability under thermal cycling and high temperatures.

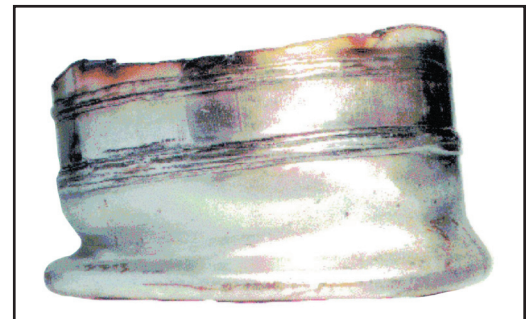
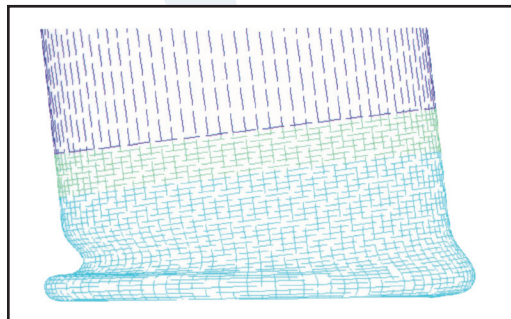
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Recent Projects

- Neutron absorbing alloy development, corrosion science, and welding engineering for Yucca Mountain Repository
- Design and testing of specialized in-pile instrumentation for measuring temperature, thermal conductivity, and deformation
- Development and evaluation of corrosion-resistant coatings for in-pile applications
- Materials and welding engineering support for INL nuclear fuel and waste treatment facilities such as the NWCF and FAST facilities
- Determination of DOE spent nuclear fuel canister response to accidental drop loads
- High temperature heater development for testing with depleted uranium dioxide, Japanese Nuclear Power Engineering Corporation, ~\$1.0M/year

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Comparison of computer simulation and experimental validation of accidental drop event at very high strain in support of spent nuclear fuel canister development.

science

INL
Idaho National
Laboratory

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- Development and assessment of in-vessel core catcher for advanced high power light water reactors, DOE International Nuclear Energy Research Initiative, \$400 K/year

Collaborations

- Sandia National Laboratory and Lehigh University for the development of the advanced neutron absorbing alloys
- Pennsylvania State University, Prof. F.B. Cheung, In-Vessel Retention Strategies for High Power Reactors
- 1999 and 2004 drop testing with Sandia National Laboratories

Publications

“Microelectrochemical Investigation of Gadolinium Rich Second Phases in a Ni-Cr-Mo-Gd Alloy,” P.J. Pinheiro, T.E. Lister and R.E. Mizia, paper accepted, *Corrosion 2004*, NACE International, Houston, TX.

“Critical Experiment Analysis of a Neutron Absorbing Nickel-Chromium-Molybdenum-Gadolinium Alloy Being Considered for the Disposal of Spent Nuclear Fuel,” D.J. Loaiza, R. Sanchez, G. Wachs and R.E. Mizia, to be published, *Journal of Nuclear Materials Management*, Institute of Nuclear Materials Management.

“Development of a Corrosion Resistant, Neutron Absorbing Structural Material,” W.L. Hurt, R.E. Mizia, T.E. Lister, P.J. Pinheiro, C.V. Robino and J.N. Dupont, Paper #165, *Institute of Nuclear Materi-*

als Management 44th Annual Meeting, July 13-17, 2003, Phoenix, AZ.

“Microstructure and Corrosion Performance of a Neutron Absorbing Ni-Cr-Mo-Gd Alloy,” R.E. Mizia, P.J. Pinheiro, T.E. Lister, J.N. DuPont and C.V. Robino, Paper #679, *Corrosion 2003*, NACE International, Houston, TX.

“Development of Gd-Enriched Alloys for Spent Nuclear Fuel Applications, Part 1: Preliminary Characterization of Small Scale Gd-Enriched Stainless Steels,” J.N. DuPont, C.V. Robino and R.E. Mizia, *Journal of Materials Engineering and Performance*, Vol. 12, no. 2, 2003.

“Corium Retention For High Power Reactors By An In-vessel Core Catcher In Combination With External Reactor Vessel Cooling,” *Nuclear Engineering and Design*, J. Rempe, et al., accepted for publication.

“Conceptual Design of an In-vessel Core Catcher,” J. Rempe, D. Knudson, K. Condie, K.Y. Suh, F.B. Cheung, and S.B. Kim, *Nuclear Engineering and Design*, *Nuclear Engineering*, 230 (2004) 311-335.

“Development of an Enhanced In-Vessel Core Catcher for Improving IVR Margins,” J.L. Rempe, D.L. Knudson, K.G. Condie, K.Y. Suh, F.-B. Cheung, and S.-B. Kim, *Nuclear Technology*, *Invited paper for the Tenth International Topical Meeting on Nuclear Reactor Thermal Hydraulics Special Edition*, to be published.

“High Temperature Thermocouples for In-Pile Applications,” J.L. Rempe and S.C. Wilkings, *to be presented at the 11th International Topical Meeting on Nuclear Reactor Thermal-Hydraulics* Popes’ Palace Conference Center, Avignon, France, October 2-6, 2005.

“Preventing Failure in Spent Nuclear Fuel Canisters,” R.K. Blandford, D.K. Morton, T.E. Rahl, and S.D. Snow, *American Society of Materials, Practical Failure Analysis*, Vol. 3, Issue 4, pp. 43-49, August 2003.

“Preliminary Elevated Strain Rate Material Testing to Support Accidental Drop Analysis of Radioactive Material Containers,” S.D. Snow, D.K. Morton, T.E. Rahl, R.K. Blandford, and T.J. Hill, *ASME Pressure Vessels & Piping Conference*, San Diego, CA, ASME PVP-Vol. 483, pp. 197-201, July 2004.

“Impact Testing of Stainless Steel Materials,” R.K. Blandford, D.K. Morton, T.E. Rahl, and S.D. Snow, *ASME Pressure Vessels & Piping Conference*, Denver, CO, to be presented, July 2005.

“Drop Testing of DOE Spent Nuclear Fuel Canisters,” S.D. Snow, D.K. Morton, T.E. Rahl, R.K. Blandford, and T.E. Hill, *ASME Pressure Vessels & Piping Conference*, Denver, CO, to be presented July 2005.

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